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Volume 8, Number 4

WSTIAC
Weapon Systems Technology Information Analysis Center

DoD Collaboration the Wiki Way

Terminology
Organizations
Interest Areas
Technology Areas
Acronyms
Country Pages
Blogs

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14. ABSTRACT
This issue of the WSTIAC Quarterly features articles on Advances in Airborne Geophysical Systems for Ordnance mapping and Detection and a news article FCS Active Protection System in 'Top 50' Inventions. Included the WSTIAC Calendar of Events and the Directors Corner. Details on several Training Courses sponsored by WSTIAC are also included in this issue.

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Director's Corner

The feature article in this issue introduces a new resource currently available to federal employees and government contractors: DoDTechipedia. Modeled after the highly successfully Wikipedia, DoDTechipedia has been set up to provide researchers and engineers with a continually updated resource on DoD scientific and technical efforts and to bridge the gaps that hinder collaboration and technology transfer between the Services, as well as between the private sector and the DoD.

This past fall, WSTIAC became actively engaged in supporting the DoDTechipedia project. This has been a fast-paced, and rapidly expanding project that is intended to provide an extensive technical resource and forum to facilitate collaboration among DoD researchers and engineers. While there is a broad range of technical focus areas included in this resource, there are several that are pertinent to the weapon systems technology community. Listed below are some areas that are particularly noteworthy.

Advanced Electronics – This area includes photonics, microelectronics and electro-optic technology for the advancement of military systems and as force multipliers.

Directed Energy Technology – This area covers topics such as models, tactical requirements, training and education, lasers, high-power microwaves, and non-lethal applications.

Electro-Optical and Infrared Sensors – This area includes information on the detection and countering of improvised explosive devices (IEDs), counter Man Portable Air Defense Systems (MANPADS), and night vision.

Energy and Power – This area covers various energy and power technologies and traditional and alternative energy sources, such as petroleum, synthetic and biofuels.

Networking Unmanned Vehicles – This area covers communications protocols, ground control systems, hardware, interoperability, modeling and simulation, software, and spectrum management for unmanned vehicles.

Radar – This area includes topics such as ballistic missile defense; counter-rocket, artillery, and mortar (C-RAM); foliage penetration radar; and through the wall radar.

Robotics – This area covers topics related to basic and applied research in robotics, commercial and industrial robotics, components and subsystems, and military and security applications.

Sensor and Data Fusion – This area includes topics related to networked sensor systems capable of deployment over large environments and integration with a large number of systems.

Systems Engineering – Examples of topics in this area include the systems engineering technical review process and the work breakdown structure.

Unmanned Systems – This area covers topics on unmanned systems including human-machine interaction; learning and adaptability; multi-system control, teaming, and scalability; perception; and verification and validation.

For DoDTechipedia to fully achieve its purpose, it requires contributions from the larger DoD scientific and technical community. This resource is intended to be self-sustaining and kept current through the edits and contributions of users. I encourage all eligible readers to register (see "How to Register for Access" on page 5) for this free and valuable resource, and then contribute to topics related to your area of expertise.

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DoDTechipedia: The DoD's New Online Technology Resource and Collaboration Space

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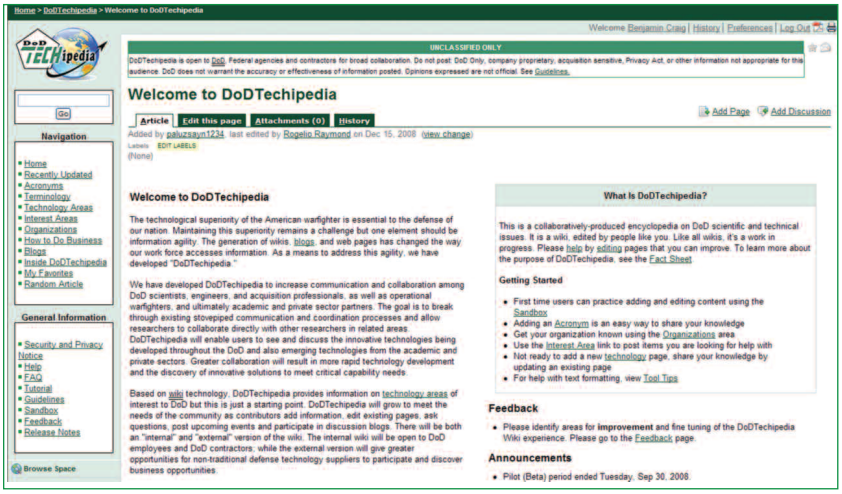
Since its creation in 2001, Wikipedia, the online and collaboratively produced encyclopedia, has become one of the most widely accessed Internet resources in the world. Wikipedia's popularity, at least in part, is due to the amount of research being conducted via the Internet. In continued efforts to foster collaboration, technology transfer, and transparency, and to reduce duplication of effort, the Department of Defense (DoD) has launched its own wiki*: DoDTechipedia.

WHAT IS DODTECHIPEDIA?

DoDTechipedia is an online information wiki that contains encyclopedic information on numerous scientific and technical areas relevant to the DoD mission and allows users to make contributions through adding, editing, and updating information. At the direction of the Director of Defense Research and Engineering (DDR&E), the Defense Technical Information Center (DTIC) launched DoDTechipedia in October 2008.



Mission and Objectives

The mission of DoDTechipedia is to facilitate the collaboration of DoD scientists, engineers, program managers, acquisition professionals and warfighters. The collaborative wiki is designed to create a forum for achieving this mission and enabling communication among these researchers, requirements developers, acquisition professionals and end users. Successful collaboration results in technological solutions and advancements, reduced costs, added capability through innovation, and reduced duplication of effort. DoDTechipedia is also designed to facilitate the rapid development of technology and innovative solutions to meet critical needs and fill technology gaps in support of defense operations.

WHAT IS IN DODTECHIPEDIA?

DoDTechipedia is set up much like the Wikipedia site it is modeled after. Each page has the navigation bar and search box on the left to allow users to easily navigate the wiki. Near the top of each page is a series of tabs that allows users to update the content on the page or view the history of the page. DoDTechipedia contains a variety of content including Technology Areas, Acronyms, Terminology, Interest Areas, Organizations, and related Technology Area Blogs.

Technology Area Pages

The primary focus of DoDTechipedia is the development of informative wiki pages on technology areas relevant to the DoD mission. The Technology Areas home page contains an expanded alphabetical index of all technology areas and their subtopics. Each top-level and sub-level topic is hyperlinked to allow the user to go directly to the topic of interest. The expanded index also serves as a quasi-taxonomy of DoD science and technology investment areas and enabling technologies of interest to the DoD.

Country Pages

Similar to Technology Area pages, Country Pages contain science and technology information. The difference, however, is the Country Pages focus on advances made by particular countries.

Acronyms

DoD is known for its extensive use of acronyms. To provide readers with a quick access resource, DoDTechipedia contains a section devoted to an extensive list of acronyms and the expanded notation of each acronym. These acronyms are linked to pages throughout DoDTechipedia by allowing the definition to be displayed when the cursor is hovered over a double underlined word.

DoDTechipedia Terminology

Unmanned Vehicle: A powered vehicle that does not carry a human operator, can be operated autonomously or remotely, can be expendable or recoverable, and can carry a lethal or nonlethal payload. Ballistic or semi-ballistic vehicles, cruise missiles, artillery projectiles, torpedoes, mines, satellites, and unattended sensors (with no form of propulsion) are not considered unmanned vehicles. Unmanned vehicles are the primary component of unmanned systems.

DoDTechipedia Blogs

Advanced Electronics
Advanced Microelectronics Packaging
Armor Technology
Augmented Reality
Biometrics
Cognitive Enhancements
Combating WMD
Controlled Unclassified Information
Directed Energy Technology
Electro-Optical Infrared Sensors
Energetic Materials
Energy and Power
Foundational Sciences
Human Systems Integration
Information Assurance
Information Warfare
Manufacturing Science and Technology
Metamaterials
Monitoring Marine Environments
Networking Technology
Networking Unmanned Vehicles
Radar
Robotics
Sensor and Data Fusion
Social Software
Specialty Materials for Airships

Terminology

For those unfamiliar with certain scientific and technical areas, a list of key words and terms are defined in the Terminology area. In addition to scientific and technical terms, the terminology page contains definitions for commonly used wiki terms, such as WikiGnome. Like Acronyms, certain terms included in pages throughout DoDTechipedia are linked to the Terminology area.

Interest Areas

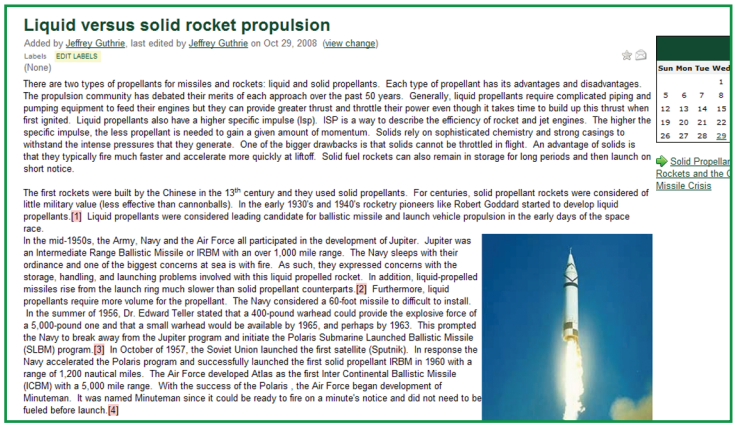
The Interest Areas page is a forum for any user whether a program manager or a soldier overseas with a specific immediate or emerging technological interest or need, to post questions for the DoD Science and Technology (S&T) community. These Interest Areas represent technical challenges that the DoD faces in maintaining military readiness and effective mission capabilities. Links to relevant technology areas lead the user to some of the collaborative solutions that have been achieved or are in-progress.

Organizations

DoD is a massive entity with a large number of components, organizations, agencies, and affiliated programs involved with funding, researching, developing, testing, demonstrating, implementing, transitioning, procuring or managing science and technology. Listed on the main Organizations page of DoDTechipedia are those organizations directly as well as indirectly supporting DoD. Each organization has a link to a separate page which provides more detail.

Blogs

A web log, more commonly known as a blog, is a series of focused postings on a particular topic or subject. Blog postings are usually made by an individual who "owns" or maintains the topic or subject blog. In DoDTechipedia, blog postings are restricted to the "blog owners," while blog comments are open to the entire community. Postings are often commentaries on recent events, publications, announcements, or anything else relevant to the subject area. DoDTechipedia currently has more than 25 blogs on Technology Areas of high interest to the DoD. These blogs are maintained by subject matter experts in the particular technology area. DoDTechipedia is always looking for additional "blog owners."



Example of a DoDTechipedia Blog.

Other Features

Since the content of DoDTechipedia is almost continuously being updated, the administrators of the wiki provide several other features to aid users in staying current with the information available. For example, users can opt to receive a triggered email when a particular page has been updated or created, a blog posting has been added, or a discussion item has been posted to a particular page or blog. Users can also receive a daily summary of all updates. In addition, the wiki allows users to store preferences such as favorite pages.

Help, Frequently Asked Questions, a printable Job Aid, and Tutorial pages provide information to allow a user at any level of wiki experience to research, edit, or update content on DoDTechipedia. Guidelines give users boundaries in terms of what type of information is allowed and what is not allowed.

Many of the Blog and Technology Area pages are conducive to active discussions about the topic. DoDTechipedia allows users to add comments or questions to the blog or page. In most cases where appropriate, if the comment or question is posted on a blog, the blog owner will respond.

WHAT TECHNOLOGY AREAS DOES IT COVER?

DoDTechipedia was initially populated using DDR&E's strategic science and technology priorities, and the scientific and technical topics covered in DoDTechipedia continue to expand. Each area has multiple sub-topics that are increasingly specific, and are organized to create a taxonomy-like structure of technologies that are of particular interest or importance to the DoD scientific and technical community. A list of Technology Areas included in DoDTechipedia is listed on page 5. The wiki environment easily allows the topics and sub-topics to be reorganized to alter the taxonomy-like structure as DoDTechipedia matures.

WHAT ARE THE BENEFITS?

Since scientific advancement and technology development occurs through a vast array of DoD organizations, programs, and projects, a challenge commonly faced by the DoD community is the difficulty in keeping abreast of the advancements and developments that may be relevant and beneficial to other areas.

DoDTechipedia is intended to eliminate some of these barriers and mitigate these types of challenges. The wiki environment enables the DoD community to more readily collaborate with private organizations on scientific advancements and technology development. As an approach without departmental barriers, DoDTechipedia also facilitates joint collaboration on R&D efforts between military services. This will help to overcome some of the traditional communication and coordination barriers that have inhibited cooperation in the past.

http://wstiac.alionscience.com/quarterly

WHO CAN ACCESS DODTECHIPEDIA?

DoDTechipedia is open to DoD employees, DoD contractors, federal agencies, and federal agency contractors. Registration is required for access and eligible individuals can access and contribute to DoDTechipedia openly. Federal employees and contractors who are already registered with DTIC can readily gain access to the DoDTechipedia wiki using their login and password information at the following URL: https://www.dodtechipedia.mil/

In addition to being able to use the DTIC login ID and password, DoD employees and DoD contractors can use their Common Access Card (CAC) to gain access to DoDTechipedia.

How to Register for Access

Individuals who qualify and are interested in using DoDTechipedia, but are not registered with DTIC and do not have a CAC, can complete the quick registration process, beginning at: https://register.dtic.mil/wobin/WebObjects/DTICreg

Once registered for DTIC, users can access DoDTechipedia with their login ID and password. DTIC provides registration support between 7 am and 5 pm Eastern time, Monday through Friday.

DTIC Registration Support
Phone: 703.767.8273, DSN: 427.8273
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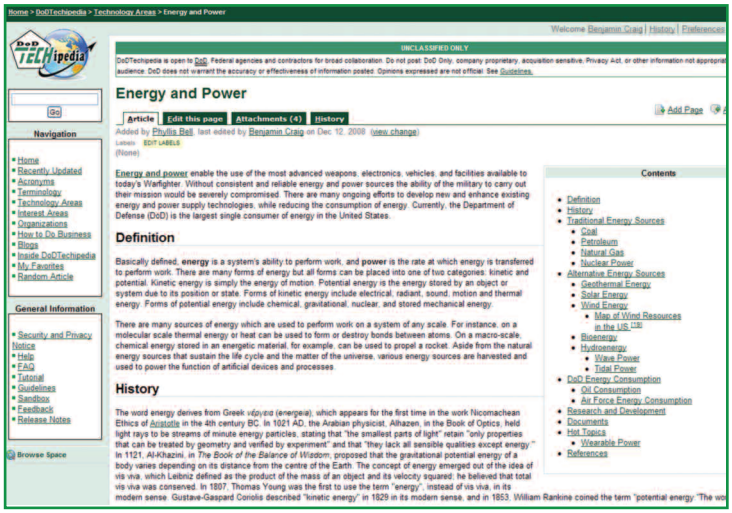
Email: reghelp@dtic.mil

Address: Defense Technical Information Center
Registration Team (DTIC-BC)
8725 John J. Kingman Road, Suite 0944
Fort Belvoir, VA 22060-6218

Who Should Contribute?

Technology Area pages are intended to be analogous to Wikipedia pages. For instance, any registered user of Wikipedia has the ability, authority and responsibility to upload new content, and/or modify existing content such that it is the most relevant, up-to-date, and useful information available so long as it falls within the guidelines of the site. Registered users of DoDTechipedia are similarly encouraged to add new content and improve existing content in the areas of their respective scientific, technical and/or programmatic expertise.



Example of a Technology Area Page.

Details on how to contribute are given within DoDTechipedia. There are instructions, Help pages, Tutorials, style guidelines, wiki markup language help pages, and much more to help users with experience levels ranging from beginner to intermediate to advanced. This information covers topics, such as how to edit pages, how to create a personal space, how to adopt a blog, and information about the wiki markup language.

Users are encouraged to share their knowledge, ask questions, post events, start and maintain a blog in order to ensure that DoDTechipedia has the most valuable information possible. This will allow the most important technologies to reach the warfighter without the traditional communication obstacles.

Need Help with DoDTechipedia?

DoDTechipedia has a core team of administrators. Questions can be emailed to dodtechipedia@dtic.mil and prompt responses will be provided. This team can assist users on a variety of subjects including content, wiki organization, wiki markup language, blog owner requests and more.

NOTE

* Wiki is defined by the Merriam-Webster Dictionary as "a web site that allows visitors to make changes, contributions, or corrections."

DoDTechipedia Technology Areas

Advanced Electronics
Advanced Medical Research
Advanced Microelectronics Packaging
Advanced Technology Fire Support Systems
Armor Technology
Augmented Reality
Behavioral Modeling
Biometrics
Cognitive Enhancements
Collaboration Systems
Combating WMD
Data Mining
Design Engineering in the Government
Directed Energy Technology
Electro-Optical Infrared Sensors
Energetic Materials
Energy and Power
Foundational Sciences
Full Spectrum Crashworthiness
High Throughput Computing
Human Systems Integration
Information Assurance
Information Technologies
Information Warfare
Intelligent Navigation and Sensing
Manufacturing Science and Technology
Metamaterials
Mixed Reality
Model Based Enterprise
Monitoring Marine Environments
Network Centric Data Sharing Technologies Portal
Networking Unmanned Vehicles
Networking Technology
Radar
Robotics
Rocket Propulsion
Sensor and Data Fusion
Social Software
Software Development Technology
Space Situational Awareness
Specialty Materials for Airships
SuperConducting Electronics for RF Applications
Superconducting Generators and High-Temperature Superconductors
Systems Engineering
The Mission Means Framework
Unmanned Systems
Wireless Technologies

WSTIAC

Weapon Systems Technology Information Analysis Center

Free Inquiry Service

WHAT'S YOUR QUESTION?

WSTIAC provides a government subsidized, free technical inquiry service. We have the expertise to jump-start or support your project – the first four hours of every question are free.

What is the WSTIAC Inquiry Service?

As one of the Department of Defense Information Analysis Centers (IACs), we provide up to four free hours to answer technical and bibliographic inquiries related to our scope – weapon systems technology.

Who is Eligible to Use the Service?

We have answered inquiries for individuals from DoD contractors and virtually all branches of the DoD.

How Does WSTIAC Obtain Answers to Technical Inquiries?

We manage an extensive library of government technical reports, conference papers, presentations, and journal articles related to weapon systems technology.

With an experienced technical staff on hand and an extensive network of subject matter experts, answers are obtained quickly and efficiently.

What If My Inquiry Takes More Than 4 Hours?

Sometimes an inquiry will require extended services. These services include comprehensive literature searches, summarizations of literature results, property compilations, analysis, test planning and engineering design.

If your inquiry requires more than four hours of support, we will discuss our extended research and engineering options and provide a tailored cost estimate that best suits your needs. Ultimately all parties must agree to a work contract prior to any work beyond the four free hours of support.

How Do I Submit an Inquiry?

You can submit an inquiry on our website at http://wstiac.alionscience.com/experts, by sending an email to wstiac@alionscience.com or by calling 877.WST.USER (877.978.8737).

We provide answers to customers looking for copies of reports, legacy data and information, or engineering consulting services.

Below are just a few of the numerous inquiries submitted to us each month:

Are there any data that defines the minimum set of critical skills needed by a program office technical staff to properly execute a disciplined systems engineering process?

Could you assist in finding the "Net Explosive Weight" (NEW) of the Stinger missile to use for explosive safety calculations?

What technology modifications are called for in the Apache BLK 111 upgrade program?

In order to develop an appropriate environmental stress screening (ESS) profile (or highly accelerated stress screening – HASS) for power supplies, how often and when is it recommended to turn the supplies on and off to test them and why? Is it recommended voltage is monitored 100% of the time when transitioning cold to hot?

Can you provide information (e.g., perform a document search) on spectral intensities of bullets?

Is the Latvian 120mm Mortar NATO Standard? If not would their ammunition be NATO Standard?

Can you provide information concerning where/how to locate/access databases containing measures of effectiveness of real-world applications of the DoD's directed energy, non-lethal weapons technologies (particularly lasers)?

Is Dechlorane Plus (tradename of occidential chemical CAS # 13560-889-9) used as a fire retardant in the liners of DoD rocket motors?

Can you provide information on available IED training resources?

PUT OUR EXPERTS TO WORK FOR YOU

Advances in Airborne Geophysical Systems for Ordnance Mapping and Detection

William E. Doll
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INTRODUCTION

Over the past ten years, several developments have been made in helicopter geophysical systems for detection and mapping of unexploded ordnance (UXO). Early total field magnetometer systems for this application invoked a novel boom-mounted sensor design, which enabled safe operation at altitudes of a few meters above ground level, and permitted detection of individual small ferrous objects. The first such system, the Aerodat HM-3, had three cesium vapor magnetometers at spaced six meters apart, mounted at the tips of one forward and two lateral booms.[1] Subsequent improvements to total magnetic field systems incorporated as many as eight magnetometers at 1.7m spacing, as in the ORAGS-Hammerhead and ORAGS-Arrowhead systems.[2] Since that time, improved magnetometer systems have been developed, and a 'production' time-domain electromagnetic system has been introduced.

Figure 1. VG-22 Vertical magnetic gradient system.

SENSITIVITY OF MAGNETOMETER SYSTEMS

The sensitivity of total field systems is ultimately constrained by the magnetic signature of the airframe and the nominal 6.5Hz noise from the rotor of the aircraft (a Bell 206 Long Ranger was used in this study), which varies in frequency content and phase over time and as a function of sensor location. This noise falls within the spectral band of many of the anomalies of interest for the ranges of altitude and forward speed that are appropriate for data acquisition. Thus traditional aeromagnetic compensation, bandpass, high-pass, and low-pass filters all have limitations. Alternatives, such as the adaptive hum filter have also had mixed success.[3]

A significant increase in system sensitivity was recently demonstrated with the introduction of the Battelle VG-16 and VG-22 (Figure 1) systems, which incorporate a vertical gradiometer configuration. The VG-16 system uses a design that is very similar to that of the ORAGS-Arrowhead, but with a pair of magnetometers, one above the other, replacing each individual magnetometer of the Arrowhead configuration. The design was based on earlier prototype measurements.[4] The VG-22 system has a higher density of magnetometers (seven pairs at one meter horizontal separation) in the forward array. Essentially, these systems are more effective because they use common mode rejection to reduce magnetic rotor noise.[5, 6] Results for the VG-22 system from a 2007 New Mexico demonstration, sponsored by the Environmental Security Technology Certification Program (ESTCP) are shown in Figures 2 and 3.

Table 1 shows the 2007 detection results for the VG-16 and VG-22 systems for 88 test ordnance items. These items were emplaced at a 521-acre area within the New Mexico site as a "blind-seeded" test, wherein the number and locations of the test items were not disclosed until after an anomaly list was provided to the sponsor (ESTCP). The results were compiled by the sponsor, where a successful detection was credited if the specified anomaly location was within 1.5m of the actual location. The

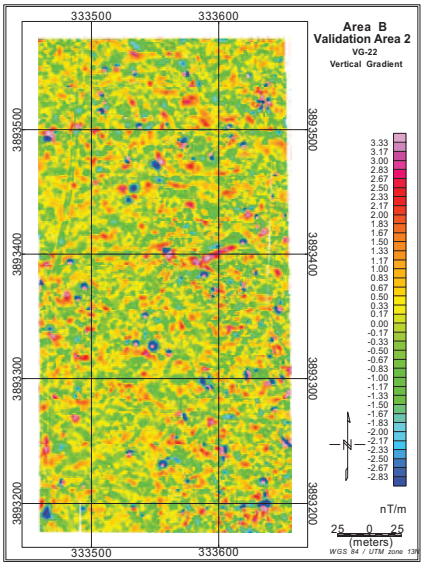

Figure 2. Vertical magnetic gradient results for an area in New Mexico from VG-22 data.

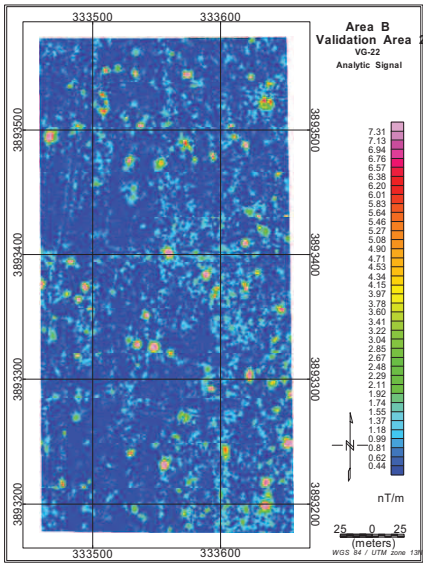

Figure 3. Analytic signal map for the area shown in Figure 2, from VG-22 data.

This article was originally published in the November 2008 issue of The Leading Edge *and is reprinted with permission.* http://dx.doi.org/10.1190/1.3011018

Table 1. Detection results for a New Mexico test based on 5560 selected VG-16 anomalies (11 anomalies/acre) and 6391 VG-22 anomalies (12 anomalies/acre).

Type	Total Seeded	VG-16	VG-16 Pd	VG-22 Detected	VG-22 Pd	TF Pd (2003)
155 mm Proj.	23	23	100%	23	100%	–
105 mm HEAT	13	13	100%	13	100%	–
105 mm Proj.	7	6	86%	7	100%	38-73%
81 mm Mortar	18	13	72%	18	100%	38-48%
60 mm Mortar	18	2	11%	10	56%	20-25%
57 mm Proj.	5	2	40%	4	80%	–
40 mm Proj.	4	0	0%	4	100%	–
Total	88	59	67%	79	90%	38-56%

probability of detection, P_d, represents the percentage of seeded items that were successfully detected. The last column lists the range of P_d values from a comparison of two airborne total field (TF) systems that were tested by the same sponsor in 2003 at a similar site approximately 50km from the 2007 site (see reference [6] for additional details).

APPLICATIONS

Airborne systems offer an alternative to ground-based (vehicle-towed and man-portable) systems for evaluation of UXO-contaminated sites. Airborne systems typically are less sensitive than ground-based systems due to their greater stand-off distance between sensor and target, and a more contentious noise source (the helicopter). However, the airborne platform offers data acquisition at rates of hundreds of acres/day, compared to tens of acres/day for vehicle-towed systems and several acres/day for man-portable systems. Airborne systems can achieve sub-meter precision in locating target items. The primary utility of the total magnetic field systems has been in mapping and detection of large ordnance items, such as M-38 practice bombs, and reconnaissance, generally referred to as 'wide-area assessment' in the UXO industry.

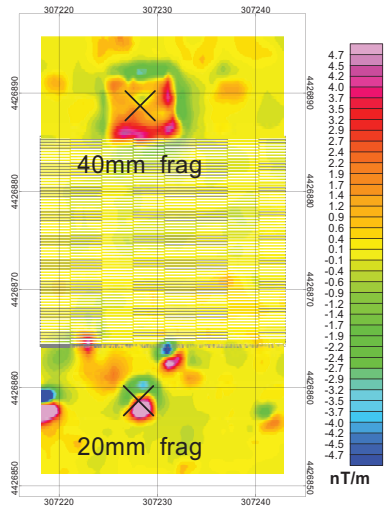

Figure 4. Airborne survey results over two simulated, high density clusters. Targets are generally too small to be detected individually, but are clearly visible as clusters and accurate density calculations can be made if the target type is known and uniform.

For wide-area assessment, the airborne systems are expected to detect a portion of the individual ordnance items, or the composite response of two or more nearby items. The responses of individual items have been measured as a function of orientation and standoff distance, and can be estimated.[7] The viability of airborne systems for a particular site can be evaluated by using these estimates of ordnance response when the types of ordnance at the site are known, and where the flight height (constrained primarily by vegetation and topography) can be accurately estimated. Statistical tools have been developed to assist in planning and evaluating these surveys.[8, 9]

For small ordnance or large sensor stand-off distance, a conceptual framework for evaluating the density of closely-spaced items with an airborne magnetometer system has been developed.[10] The study provides a rule of thumb for determining whether anomalies from two items will be discrete or overlapped. When working with vertical magnetic gradient data, the equivalent ratio of horizontal separation to sensor height above the target, referred to as the separation/height ratio (SHR), would predict anomalies to be overlapped for values of SHR <0.4, partially overlapped for 0.4<SHR<1.2, and discrete for SHR>1.2. This relationship between SHR and overlap has proven consistent with results from closely-spaced blind-seeded items emplaced at the New Mexico test site.[6] When items are sufficiently close together that their individual peaks cannot be resolved, their collective response simulates that of a horizontal sheet. If one can assume that all of the items are uniform in size and depth, then their density can be calculated from the peak magnetic response. If the density is sufficiently high, very small ordnance which would ordinarily be undetectable, become visible. Figure 4 shows an example of airborne data over simulated high-density targets. The 20mm cluster has a real density of 25 items per square meter and a calculated density of 23 items/m^2. The 40mm cluster has a real density of four items/m^2 and a calculated density of 1.8 items/m^2.

ELECTROMAGNETIC SYSTEMS

Although UXO sites are present throughout the US and at many locations worldwide, there are many sites (e.g., New Mexico, California, Hawaii) where magnetometer systems, whether ground-based or airborne, are ineffective for ordnance detection because of high concentrations of basalt or other magnetic rock or soil types. Ground-based electromagnetic systems, such as the Geonics EM-61, are typically used at these sites, and have much better performance than magnetometer systems. In fact, electromagnetic systems are predominant in ground-based investigations for UXO at all sites, except where ordnance is expected to be particularly deep.

Figure 5. The Battelle TEM-8 time-domain electromagnetic system

The development of airborne electromagnetic systems for UXO surveys is more complex than the corresponding magnetometer systems. Two prototype studies have led to development of an eight-channel time-domain system, known as the Battelle

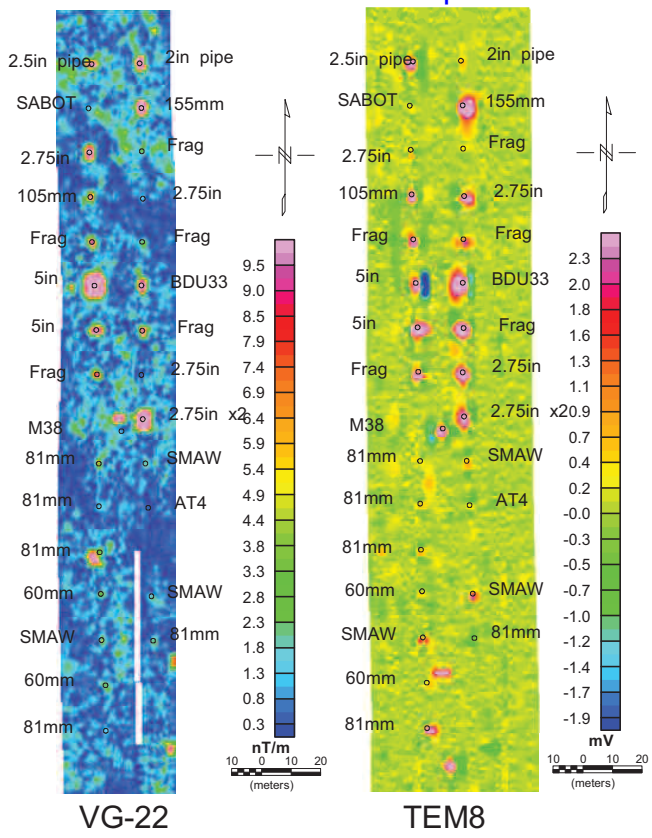

Figure 6. Comparison of VG-22 (left) and TEM-8 (right) results for two lines of ordnance test items emplaced at the surface at a site where there is moderate geologic interference.

TEM-8.[11, 12] The TEM-8 system (Figure 5) has a dual transmitter loop consisting of two 3m x 4m multiple turn loops and four 75cm x 20cm receiver coils mounted parallel to the long axis of each of the two transmitter loops. Preliminary results show that at altitudes of about one meter, the performance of the TEM-8 system is similar to that of magnetometer systems (Figure 6), and that joint interpretation of magnetic and electromagnetic datasets can reduce the numbers of false alarms.[13]

ONGOING RESEARCH

A current study for the Strategic Environmental Research and Development Program (SERDP) is aimed at evaluating airborne frequency domain electromagnetic (FDEM) approaches for mapping and detection of UXO. The study will use modeling and ground testing to evaluate whether a FDEM system could outperform the existing airborne TEM-8 system. Multi-axis receiver coils are also under consideration. Further improvements in magnetometer systems will require additional, more compact sensors, possibly arranged to measure gradients in more dimensions. Another project, led by the Idaho National Laboratory (INL), is focused on developing an airborne system that can operate on an unmanned aerial vehicle. This represents a significant engineering challenge in order to operate safely and cost-effectively at the low altitudes required for UXO surveys. Although these systems were designed to address a particular need, they could be beneficial to a wide range of applications, perhaps extending beyond the environmental and engineering disciplines into other more traditional areas of geophysical study.

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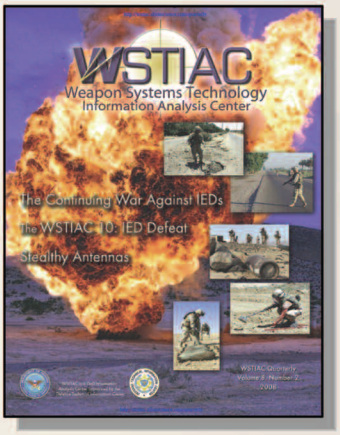

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FCS ACTIVE PROTECTION SYSTEM IN 'TOP 50' INVENTIONS

By John R. Guardiano

The Army's new Active Protection System, which is designed to safeguard Soldiers and vehicles from incoming fire, has been named one of the best inventions of 2008 by Time magazine. "Think of [it] as Star Wars for Soldiers," said Time magazine in its Nov. 10 edition. The APS "will automatically detect an incoming round and then launch a missile to destroy it, all within a split second."

The Army is developing APS as part of its Future Combat Systems ground-force modernization program. FCS is designed to bring Soldiers into the 21st century by equipping them with state-of-the-art vehicles, communication capabilities, sensors and protective systems. The APS is actually part of a more comprehensive "hit-avoidance system" that the Army is building into a suite of eight new FCS Manned Ground Vehicles types. This more comprehensive hit-avoidance system will give the Soldiers in the MGVs "full-scale 360-degree hemispherical protection," said FCS Program Manager Maj. Gen. Charles A. Cartwright. Current Army vehicles lack this level of protection because, he said, they were designed more than a generation ago, before the information technology revolution of the past quarter-century.

Metastasizing Threats

According to the Army's Training and Doctrine Command, American servicemen and women face a proliferating array of new and more sophisticated threats, which, if not addressed, will jeopardize American lives and mission success. "The threats are getting more dangerous," said TRADOC's Deputy Commanding General, Lt. Gen. Michael A. Vane. "Technology proliferation is creating a dangerous mix of state-of-the-art technology, radical extremists, and irregular tactics. "Future Combat Systems, the MGVs, the hit-avoidance system, APS," he added "these all will protect our Soldiers against a variety of changing threats and address current force limitations."

The Army's Active Protection System is still in development, but has proven itself in live-fire testing. Hit-avoidance prototypes, moreover, are scheduled for delivery in 2011, said Maj. Lewis Phillips, assistant product manager.

Current-Force Limitations

In the meantime, elements of the FCS survivability system are being incorporated into current Army vehicles on a limited basis. Because of inherent design limitations due to their age, current Army vehicles cannot accommodate a comprehensive hit-avoidance system, officials said.

In addition to being equipped with active protection, the new Army vehicles, or MGVs, also are being designed with an independent hull structure, in which armor is bolted onto the vehicle. This allows for frequent armor upgrades to accommodate technological advances. The armor on current-force vehicles, by contrast, is integrated throughout the structure of the vehicle. Current force vehicles, consequently, have a very limited ability to accommodate better and more modern armor protection, officials said.

The rocket-propelled grenade defeat test here of the FCS Active Protection System for Manned Ground Vehicles was the first time that any vertical launch APS defeated an incoming rocket RPG while mounted on a moving vehicle. Photo by FCS

IED Protection

Current-force vehicles – the Abrams Tank, Bradley Fighting Vehicle, and Stryker Interim Armored Vehicle – also were not specifically designed to withstand attack from Improvised Explosive Devices. The new FCS vehicles, by contrast, are being designed with a v-shaped hull, specifically to help diffuse IED blasts. And the seating inside the MGVs will be suspended from the ceiling of the vehicle to further reduce the shock and trauma of an IED blast. Army officials said this is significant because, for many of America's enemies, IEDs have become the weapon of choice.

IED attacks, in fact, account for the majority of US casualties in Iraq and Afghanistan and are a leading cause of brain injury to American servicemen and women. By separating occupants from the floor of the vehicle, which absorbs the blast, Soldiers will suffer much less trauma and injury, Army officials said.

Quick Kill

The FCS Active Protection System is being developed by Raytheon. Raytheon won the contract from the FCS program after participating in an open competition that involved other key competitors and competitor systems. A team of 21 technical experts from various US government agencies, the Army and private-sector industry evaluated competing Active Protection Systems. According to the Government Accountability Office, the team reached "a clear consensus... [that] Raytheon's Quick-Kill system was the best alternative."

Army officials said that one key advantage of the Raytheon APS is its vertical launch system, which protects against top-attack rounds. They said this gives Soldiers true 360-degree hemispherical protection. The FCS Active Protection System "is the only available vertical launch system that I'm aware of," Lewis said. Other Active Protection Systems out on the market employ horizontal launch systems and thus do not provide total vehicular protection. A vertical launch system, Phillips said, allows for redundant protection from all sides of the vehicle. One countermeasure situated anywhere on the vehicle can defeat any incoming round. Horizontal launch systems lack this capability, Phillips said.

(John Guardiano serves in the Plans Division of Army Public Affairs and is a frequent contributor to the Army News Service.)

ARMY BEEFS UP NON-LETHAL CAPABILITIES

By Staff Sgt. Michael J. Carden

Soldiers are trained to use non-lethal force as much as possible. But until recently, not every Soldier had "the right mix" of tools and capabilities to meet those goals, an officer said during exercises here last week. "The more capabilities we give the Soldiers to operate in the non-lethal realm, the less likely they're going to have to resort to lethal force," said Army Maj. Thomas Aarsen, a close combat systems project officer for the Defense Department's Program Executive Office Ammunition. "[The Army] has been asking Soldiers to do this for a long time, but now they have the tools to do so," Aarsen said during a Non-Lethal Capabilities Set fielding and training for two 10th Mountain Division brigade combat teams.

The Army has been improving its non-lethal capabilities since 2000 in response to US actions in Kosovo. The Army needed something to use before resorting to lethal force, Aarsen said. There were variations of non-lethal packages before. But until now, there hasn't been a system available to Soldiers with the amount of tools the latest set provides, Aarsen said. "Non-lethal capabilities has definitely been an evolving process," he said. "Technology and equipment continues to keep getting better, and we continue to keep learning more and becoming more innovative. I think now we have about the right mix of what the brigades will need. Though there may be times when they need more or less, it's a good solution at this point."

The fielding, an Army requirement, consists of five modules and comes with a weeklong training on its capabilities and uses, Aarsen said. The modules are based on tactical situations including checkpoint manning, convoy operations, detainee operations, crowd control and dismounted patrols. A Taser package sub-module with 18 Tasers and holsters also comes with the set, he said.

Instructors from the Army's military police school at Fort Leonard Wood, Missouri., who developed the training curriculum, travel to the gaining unit's installation to train the Soldiers. During the course, soldiers fire non-lethal ammunitions, such as Tasers and shotgun and grenade launcher rounds filled with rubber pellets. Soldiers also learn to use the different modules to the capacity that they can teach their squads and platoons what they've learned, Aarsen said. The equipment includes audio-translating devices and the portable vehicle arrest barrier, he added.

The voice response translator is a hand-held electronic device that can be synced to eight users' voices and translate more than 350 phrases in 18 languages. Soldiers can use it to communicate in Arabic, Farsi, Urdu and Pashtun, for example, without an interpreter, Aarsen said. The package also introduces the portable vehicle arrest barrier, which is basically a large cargo net stored inside a speed bump. Once activated, it can stop a 5-ton vehicle traveling 45 mph by wrapping around the vehicle and locking up the rear axle. Soldiers can stop a speeding vehicle without ever having to expend live ammunition, Aarsen said. "These capabilities give the Soldiers a lot more tools to use as they progress through the escalation of force," he said. "Now they have ways to actually deal with folks before they have to result to lethal force. The whole focus is to provide Soldiers with more options before they have to use lethal force."

10th Mountain Division's 2nd and 3rd Brigade Combat Teams were the seventh and eighth brigades to receive the set. The set was produced by the Program Executive Office Ammunition and costs just more than $1 million. Fielding began in July to units getting ready for deployment. Every brigade combat team and military police brigade is expected to have the issue in about 18 months, officials said.

Jeff Teats, right, a non-lethal weapons instructor, observes Spc. Yevgeniy Popov, a chemical warfare specialist assigned to the 10th Mountain Division's Headquarters Company, 3rd Special Troops Battalion, 3rd Brigade Combat Team, fire a Taser during non-lethal weapons training on Fort Drum, NY, Nov. 19, 2008. Photo by Staff Sgt. Michael J. Carden

Soldiers, assigned to the 10th Mountain Division, learn uses and techniques of a spike-strip net during non-lethal capabilities training on Fort Drum, NY. Photo by Staff Sgt. Michael J. Carden

Tom Martins, non-lethal munitions specialist, teaches 10th Mountain Division Soldiers uses and techniques of a spike-strip net during non-lethal capabilities training Nov. 20, 2008, at Fort Drum, NY. Photo by Staff Sgt. Michael J. Carden

Soldiers assigned to the 10th Mountain Division feel the effects of a Taser during non-lethal weapons training on Fort Drum, NY. Photo by Staff Sgt. Michael J. Carden

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